Instruction 106-4500
10-29-08

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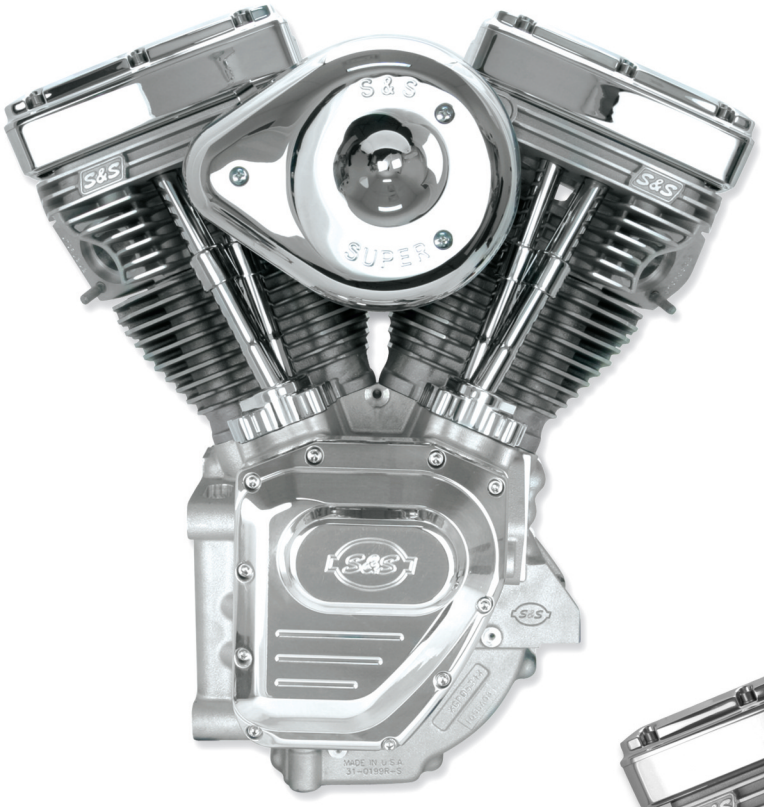
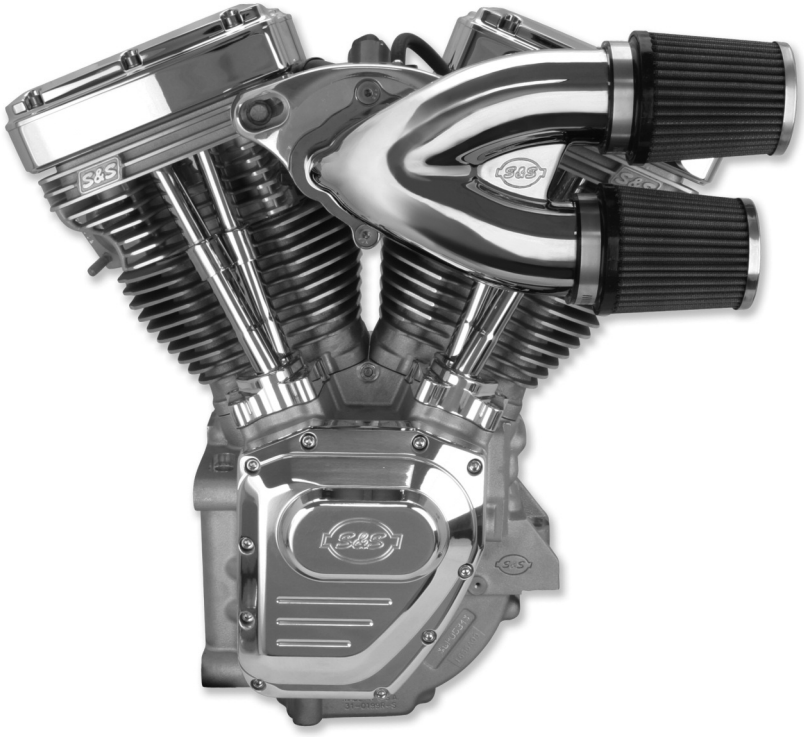
Installation Instructions: S&S® T111 Engine Assembly





DISCLAIMER:

S&S parts are designed for high performance, closed course racing applications and are intended for the very experienced rider only. The installation of S&S parts may void or adversely effect your factory warranty. In addition such installation and use may violate certain federal, state, and local laws, rules and ordinances as well as other laws when used on motor vehicles used on public highways, especially in states where pollution laws may apply. Always check federal, state, and local laws before modifying your motorcycle. It is the sole and exclusive responsibility of the user to determine the suitability of the product for his or her use, and the user shall assume all legal, personal injury risk and liability and all other obligations, duties, and risks associated therewith.

The words Harley®, Harley-Davidson®, H-D®, Sportster®, Evolution®, and all H-D part numbers and model designations are used in reference only. S&S Cycle is not associated with Harley-Davidson, Inc.

SAFE INSTALLATION AND OPERATION RULES:

Before installing your new S&S part it is your responsibility to read and follow the installation and maintenance procedures in these instructions and follow the basic rules below for your personal safety.

- Gasoline is extremely flammable and explosive under certain conditions and toxic when inhaled. Do not smoke. Perform installation in a well ventilated area away from open flames or sparks.
- If motorcycle has been running, wait until engine and exhaust pipes have cooled down to avoid getting burned before performing any installation steps.
- Before performing any installation steps disconnect battery to eliminate potential sparks and inadvertent engagement of starter while working on electrical components.
- Read instructions thoroughly and carefully so all procedures are completely understood before performing any installation steps. Contact S&S with any questions you may have if any steps are unclear or any abnormalities occur during installation or operation of motorcycle with a S&S part on it.
- Consult an appropriate service manual for your motorcycle for correct disassembly and reassembly procedures for any parts that need to be removed to facilitate installation.
- Use good judgment when performing installation and operating motorcycle. Good judgment begins with a clear head. Don't let alcohol, drugs or fatigue impair your judgment. Start installation when you are fresh.
- Be sure all federal, state and local laws are obeyed with the installation.
- For optimum performance and safety and to minimize potential damage to carb or other components, use all mounting hardware that is provided and follow all installation instructions.
- Motorcycle exhaust fumes are toxic and poisonous and must not be inhaled. Run motorcycle in a well ventilated area where fumes can dissipate.

IMPORTANT NOTICE:

Statements in this instruction sheet preceded by the following words are of special significance.

⚠ WARNING

Means there is the possibility of injury to yourself or others.

⚠ CAUTION

Means there is the possibility of damage to the part or motorcycle.

NOTE

Other information of particular importance has been placed in italic type.

S&S recommends you take special notice of these items.

WARRANTY:

All S&S parts are guaranteed to the original purchaser to be free of manufacturing defects in materials and workmanship for a period of twelve (12) months from the date of purchase. Merchandise that fails to conform to these conditions will be repaired or replaced at S&S's option if the parts are returned to us by the purchaser within the 12 month warranty period or within 10 days thereafter.

In the event warranty service is required, the original purchaser must call or write S&S immediately with the problem. Some problems can be rectified by a telephone call and need no further course of action.

A part that is suspect of being defective must not be replaced by a Dealer without prior authorization from S&S. If it is deemed necessary for S&S to make an evaluation to determine whether the part was defective, a return authorization number must be obtained from S&S. The parts must be packaged properly so as to not cause further damage and be returned prepaid to S&S with a copy of the original invoice of purchase and a detailed letter outlining the nature of the problem, how the part was used and the circumstances at the time of failure. If after an evaluation has been made by S&S and the part was found to be defective, repair, replacement or refund will be granted.

ADDITIONAL WARRANTY PROVISIONS:

(1) S&S shall have no obligation in the event an S&S part is modified by any other person or organization.

(2) S&S shall have no obligation if an S&S part becomes defective in whole or in part as a result of improper installation, improper maintenance, improper use, abnormal operation, or any other misuse or mistreatment of the S&S part.

(3) S&S shall not be liable for any consequential or incidental damages resulting from the failure of an S&S part, the breach of any warranties, the failure to deliver, delay in delivery, delivery in non-conforming condition, or for any other breach of contract or duty between S&S and a customer.

(4) S&S parts are designed exclusively for use in Harley-Davidson® and other American v-twin motorcycles. S&S shall have no warranty or liability obligation if an S&S part is used in any other application.

Instruction Contents:

1- Introduction
2- Additional Features
3- Modification Notes
4- Engine to Frame Assembly
5- Ignition System
6- Fuel System
7- Oil Line Installation
8- Exhaust System
9- Initial Start-up and Engine Break-In
10- Tuning Guidelines
11- Engine Specs and Torque Values
12- Service Intervals

Please read these instructions carefully before starting work. Proceed with the installation only after the instructions are completely understood. These instructions should be supplemented by the appropriate OEM service manual for your motorcycle. Follow all safety information.

1- Introduction

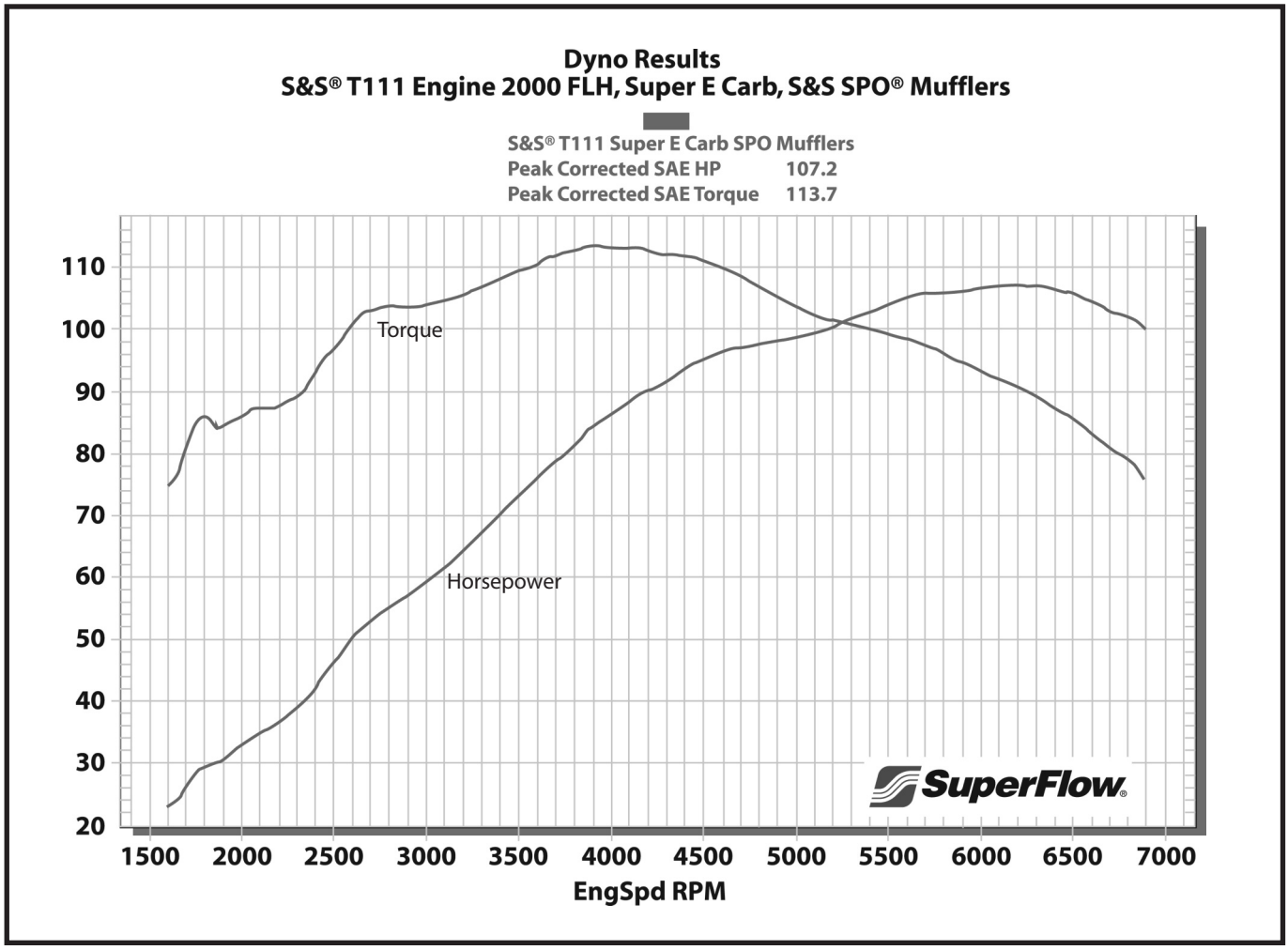
S&S® T111 Engines are designed and intended for installation in a stock Harley-Davidson® Twin Cam 88® chassis. It will bolt directly to the stock transmission and engine mounts of chassis designed for stock Twin Cam 88® engines. The T111 Engine is available in silver powder coat or black powdercoat finish.

Installation can be performed by any Harley-Davidson® repair shop equipped to do complete engine overhauls.

No special tools other than those used in normal engine building operations are required.

NOTES

- *Installation of a fuel injected engine in a motorcycle that was originally equipped with a carburetor is fairly difficult and expensive. This conversion requires a fuel pump equipped gas tank as well as wiring harness.*
- *All S&S T111 assemblies are for Twin Cam 88® non-counterbalanced engine applications, and are not for use in Twin Cam 88B® counterbalanced applications.*



Dynomometer chart showing typical horsepower and torque curves for S&S 111" T111 engine.

Horsepower and torque curves will vary, dependent on the engines state of tune, and the ignition and fuel systems used on the completed engine.

2- Additional Features:

- Greater overall strength than stock crankcases, especially in the front motor mount, an important consideration in high performance applications.
- All oil passages between the crankcase and cam support plate are O-ring sealed.
- Compatible with stock components. Use stock oil pump, cam support plate, gear cover, etc.
- Uses 1999-2002 Timken® style sprocket shaft bearing.
- Uses 2003-up pinion shaft bearing

S&S® T111 instructions often refer to procedures described in other S&S instructions or a Harley-Davidson® Service Manual. These materials should be cross-referenced as necessary.

IMPORTANT

Before proceeding, verify that serial numbers on crankcases match numbers on packing carton and certificate of origin. Contact S&S immediately if numbers do not match.

NOTE - *Valid certificate of origin is required for any transfer or sale of longblock assemblies. Certificate of origin is required to title and license any motorcycle which is to be driven on public streets and highways.*

3- Modification Notes

S&S® Cycle cautions against modifying these crankcases due to the possibility of damaging or weakening them. Modifying S&S crankcases in any fashion voids all manufacturer warranties. Should the customer elect to modify the crankcases regardless, it is imperative that they and the information tag attached to them be inspected beforehand to confirm that the correct model, style, bore size, etc. have been provided. The customer must confirm that crankcases and related parts are correct before assembling them or having them modified in any manner, and assumes all liability for modifications.

Under no circumstance will S&S be held responsible for expenses related to the modification of any S&S part in the event warranty service is required. Modified parts will not be accepted for credit or exchange. This will apply regardless of cause or fault: customer, retailer, manufacturer, or other.

For further information, contact S&S Technical Services at 608-627-8324, FAX 608-627-1488 or e-mail sstech@sscycle.com

NOTE - *Modification includes but is not limited to appearance changes such as painting, powdercoating, plating, and polishing. Proper preparation for these procedures as well as the processes themselves may require the use of polishing compounds, chemicals or procedures that are potentially harmful to crankcases.*

⚠ CAUTION

- **Passages and internal cavities may become obstructed by residues from materials used to polish, paint, plate or powdercoat surfaces. Additionally, surface finishing processes can damage critical machined surfaces. Any of the above may cause premature wear, damage or failure of other engine components as well as the crankcases themselves.**
- **Glass bead and polishing residues are abrasive and can be difficult to remove from recesses and small passages. Abrasive residues can cause oil contamination and extensive engine damage. Engine damage caused by powder coating, polishing, glass bead blasting, or other modification will not be covered under warranty.**

Powder Coating - Subjecting heat-treated alloys such as those used in S&S crankcases to excessive heat can drastically alter their strength and their critical properties. The degree of change depends upon the temperatures reached and the duration of exposure. When powder coating or otherwise processing alloy parts, S&S exposes them to a maximum temperature of 370°F for no longer than 20 minutes. Under no circumstances should parts be heated past 400°F!

S&S strongly recommends trial-fitting every engine before frame is painted or powdercoated.

4- Engine To Frame Assembly

The engine should be installed into the frame before the ignition, fuel, exhaust, and oil system components are installed.

Follow the engine to frame fitting below:

Engine to Frame Test Fit

NOTE - *The engine must be fitted to the frame it is installed into. It must rest squarely on its attachment points, and bolted solidly to the frame without stressing the engine case at any point.*

⚠ CAUTION

Failure to correctly mount the engine can cause problems not covered under warranty including but not limited to, excessive vibration, driveline mis-alignment, and broken castings.

A- Test-fit instructions for T111 style cases with stock 1999-up engine mounts.

1- Clean frame engine mounts and carefully remove any irregularities from mounting surfaces. Also inspect crankcase mounting bosses for burrs.

2- Position engine in frame, check for clearance at frame, and alignment to transmission. It is a good idea to replace rubber engine mounts at this time. Old mounts deform over time and can induce unwanted stresses on the engine case.

Replace all other motorcycle components removed for engine installation. Consult authorized Harley-Davidson® service manual for installation procedure for stock parts not covered in S&S instructions.

NOTE- *On certain models it may be necessary to switch the shift linkage to the outside of the shift lever. Make certain that there is clearance between the shifter rod and the engine crankcases.*

5- Ignition System Installation

A- All Carbureted S&S T111 assemblies come with an S&S IST (Intelligent Spark Technology) ignition. Use of this ignition system is highly recommended. All aspects of ignition timing- advance, retard, and curves are handled automatically by the S&S IST ignition.

B- Once the IST ignition has been installed per the included instruction sheet 51-1155, no other adjustments are necessary

NOTES

- *If the S&S IST ignition is not used, S&S recommends using electronic ignition with adjustable advance curve in S&S T111 engines. Adjustable curve permits slowing rate of advance to control or eliminate pinging under heavy load or when elevated temperatures or poor quality gasoline encountered.*
- *All other ignition systems other than the included S&S IST ignition install per manufacturers instructions.S&S recommends setting the total ignition advance to 28 degrees. Timing degree recommendations given by S&S take precedence over the ignition manufacturers instructions.*

⚠ CAUTION

Timing that is too advanced will result in detonation and engine damage. Timing that is too retarded will result in engine over-heating and engine damage. (This caution applies only to installations other than the S&S IST Ignition)

⚠ CAUTION

If S&S determines that engine damage was caused by improper ignition timing, repair will not be covered under warranty.

Excessive ignition advance will cause engine to kick back against the starter during start-up and "buck" when ridden at steady speed with partial throttle. An advanced condition can also cause pinging or ignition knock and possible piston damage. These symptoms may not be noticed if electronic ignition with "soft" advance curve is used.

Excessive ignition retard causes sluggish performance and severe overheating with possible subsequent damage to the engine, and must also be avoided. Immediate or rapid exhaust pipe discoloration is usually a sign of retarded ignition timing.

6- Fuel system installation and tuning

NOTES - *S&S® Engine assemblies are available with either carbureted or fuel injected systems.*

Assembled Engines *are shipped with the carburetor or fuel injection system installed. Refer to the included instructions for operation and tuning .*

A- Install fuel system.

1- Engine assemblies supplied with Super "E" carburetors, refer to included instruction sheet 51-1012.

2- Engine assemblies supplied with fuel injection, refer to included Induction System instruction Sheet.

B- Re-install and connect fuel tank.

1- Refer to appropriate service manual. Inspect fuel lines and clamps - replace as necessary.

2- Check fuel line connections and routing. Avoid hot surfaces. Make certain that the protective cover has been placed over fuel line, and that it is clear from sharp edges and abrasive surfaces.

3- Fill the fuel tank with a sufficient quantity of gasoline for the initial start-up procedure.

4- Double check that all fuel line connections have been made correctly and there is no gas leakage at any point in the system.

7- Oil Line Installation

A- For 1999-2006 Harley-Davidson® FL models

⚠ CAUTION

Oil line installation is crucial to engine life. If you are not sure that you can properly perform this operation, please contact the S&S Tech Department for a referral to a shop in your area.

NOTE- *Installation instructions are based on an engine and transmission already in the chassis.*

FL Oil Line Install Kit (PN 31-0425)

NOTE- *Apply thread sealant to all tapered pipe threads.*

1- Remove the stock oil supply and return fittings from the transmission.

2- Install two supplied ⅜ NPT pipe plugs (S&S PN 50-8330) in the oil fitting location.

NOTE- *Apply thread sealant to all tapered pipe threads.*

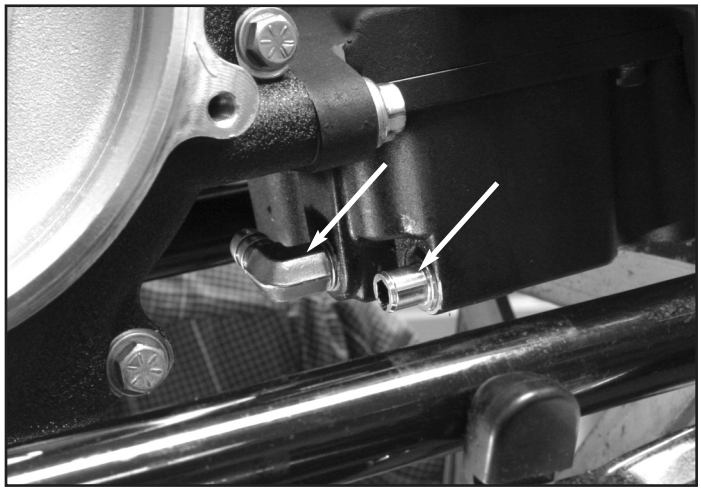
3- Remove crankcase vent fitting (S&S® PN 50-0451) and set aside for later use. Install supplied vent fitting (S&S PN 50-0449 is for use with 2002-'06 with 7/16 ID vent hose or 50-0454 for use with 1999-'01 with ⅜ ID vent hose) with O-ring installed on fitting. **See Picture 1.**

Picture 1 (2002-'06 Shown)

4- Install the vent hose and clamp (S&S PN 50-8156 or 50-8076-S) on the new fitting.

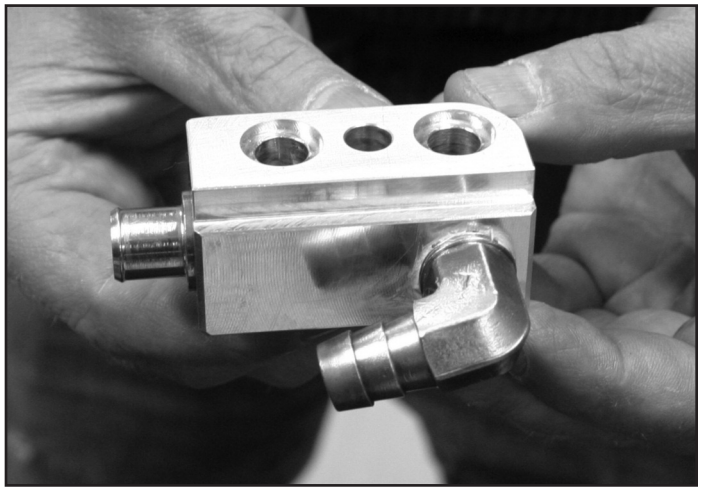
NOTE- *The stock vent hose is reused in this step.*

5- Position a drain container in front of the oil pan. Next, locate and remove the two plugs on the forward face of the oil pan allowing the oil to drain. Once the oil is completely drained, replace the ⅜" pipe-plug with a 90-degree fitting (S&S PN 50-8288). Position barb of fitting toward right side of bike at an angle slightly above horizontal as shown in **Picture 2**. Next, install the oil return fitting (S&S PN 50-0451) with O-ring (S&S PN 50-8008) in the drain plug location.



Picture 2

6- Remove cover plate that was shipped on crankcase from the bottom surface of the rear motor mount. The oil line block will be installed in this location. Assemble the oil line block by installing the 90-degree fitting (S&S PN 50-8288) and the oil return fitting (S&S PN 50-0451) with O-ring (S&S PN 50-8008) into the block, as shown in **Picture 3**.



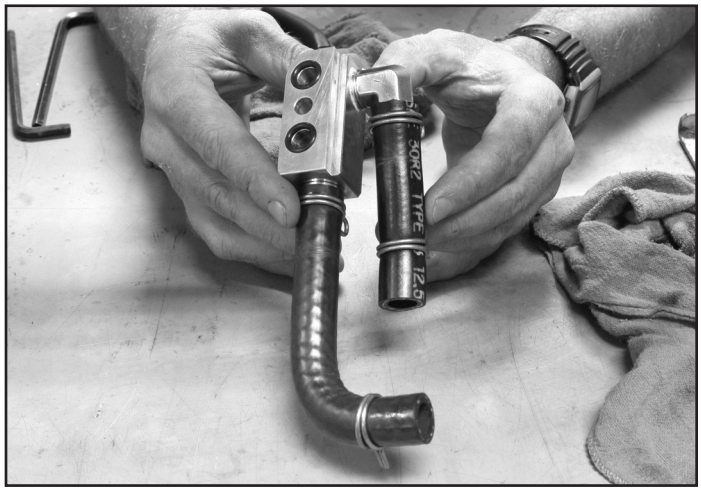
Picture 3

7- Mount the oil line block on the crankcase using 5/16-18 x 1¾" long screw (S&S® PN 50-0437)—do not final tighten as it will be removed again.

8- The next step is to measure and then cut the oil hoses. The straight hose connects the 90 degree fittings of the oil line block and oil pan. The bent hose runs between the oil return fittings on the oil line block and oil pan. **See Picture 4.**

Picture 4

9- Remove the oil line block from the engine case. Install the supplied clamps (S&S PN 50-8156) on the lines between the fittings. **See Picture 5.**



Picture 5

10- Install O-Rings (S&S PN 50-8066) in the counter bores of the oil line block. Position the oil line block on the engine case and tighten the screw to 18 ft-lbs. of torque with blue threadlock on the threads. **See Picture 6.**

Picture 6

11- Position hose clamps over the fittings.

To Change Engine Oil in the Future

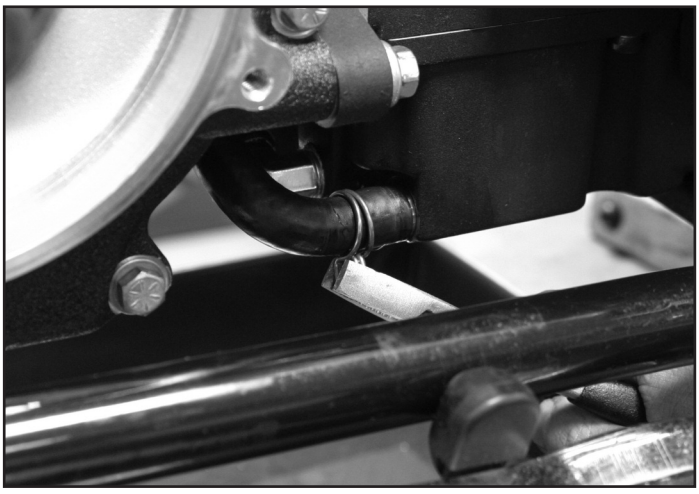
1- Slide hose clamp off of fitting along hose. **See Picture 7.**

2- Place an oil drain pan under front of oil pan.

3- Remove hose from fitting to drain oil.

4- Reinstall hose and clamp.

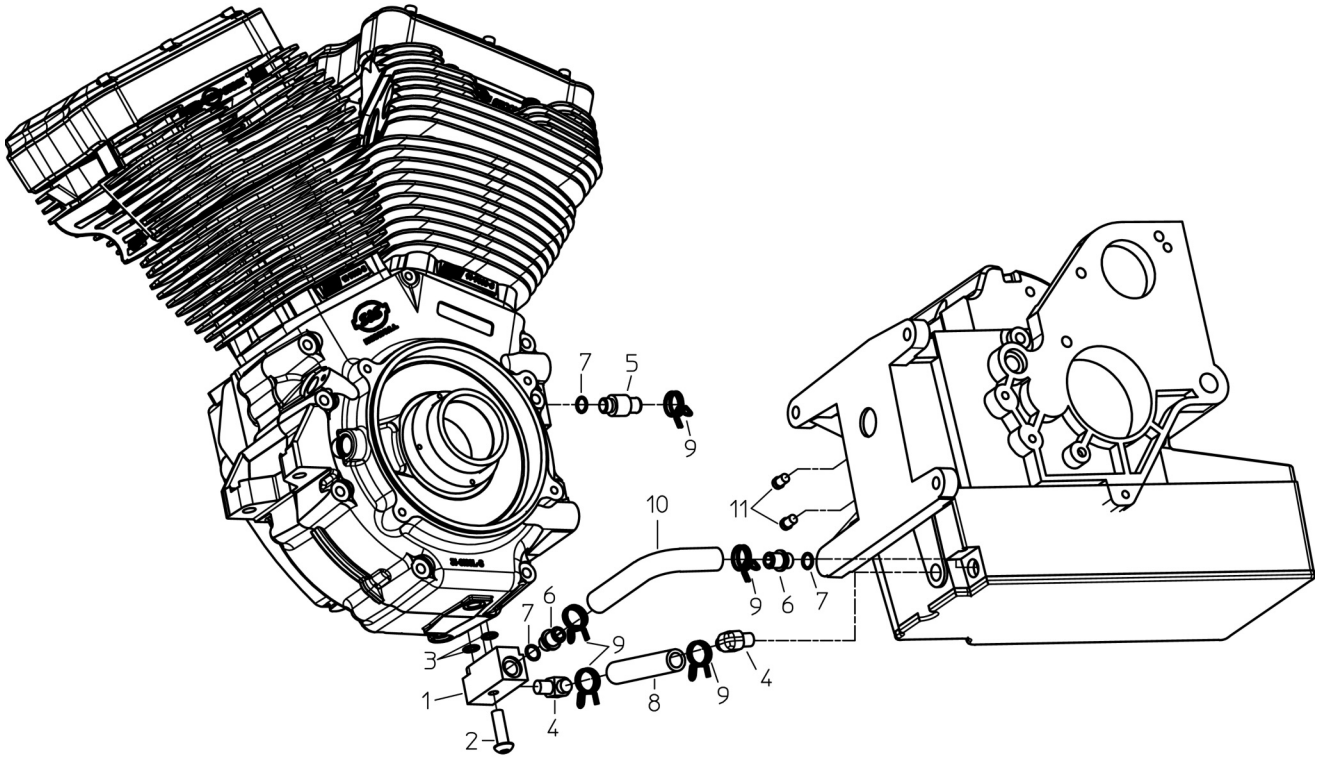
5- Continue with recommended oil change procedure.



Picture 7

S&S® Replacement Parts for Harley-Davidson® FL Models

1- Block, Oil line **106-1168**
2- BHSHCS, 5/16-18 x 1¾ *(10 pack)* **106-1169**
3- O-ring *(10 pack)*.....**50-8066**
4- Fitting, Pipe, 90 degree *(2 pack)*.....**106-1170**
5- Fitting,
7/16 *(2 pack)*.....**106-1171**
⅜ *(2 pack)* **106-1172**
6- Fitting, ½ *(2 pack)*.....**106-1173**
7- O-ring *(10 pack)*.....**106-1183**
8- Hose, oil feed **50-8157**
9- Clamp,
Double Wire Spring *(10 pack)*.....**50-8156**
Hose, Spring *(10 pack)* **106-1174**
10- Hose, Oil Line, 90 degree bend **50-8292**
11- Plug, pipe *(10 pack)*.....**106-1175**

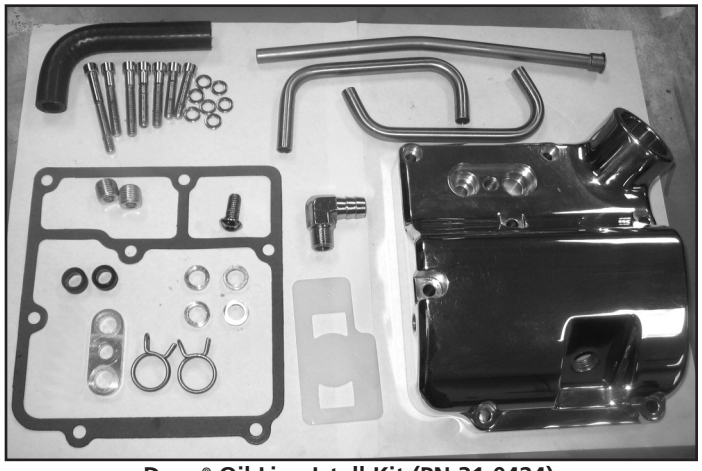


B- For 1999-'05 Harley-Davidson® Dyna® models

⚠ CAUTION

Oil line installation is crucial to engine life. If you are not sure that you can properly perform this operation, please contact the S&S Tech Department for a referral to a shop in your area.

NOTE: *Installation instructions are based on an engine and transmission already in the chassis.*

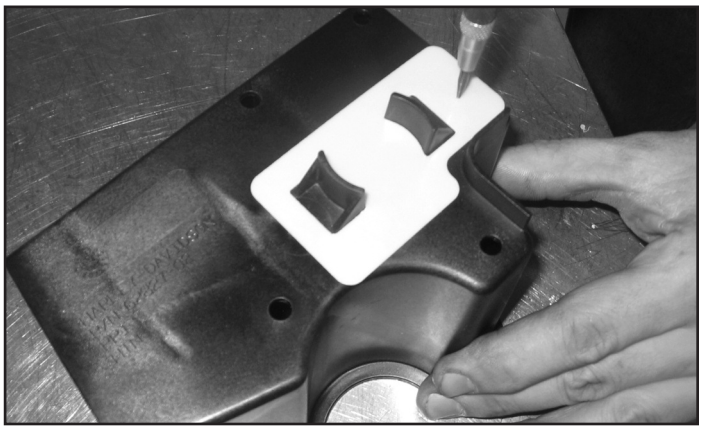


Dyna® Oil Line Istall Kit (PN 31-0424)

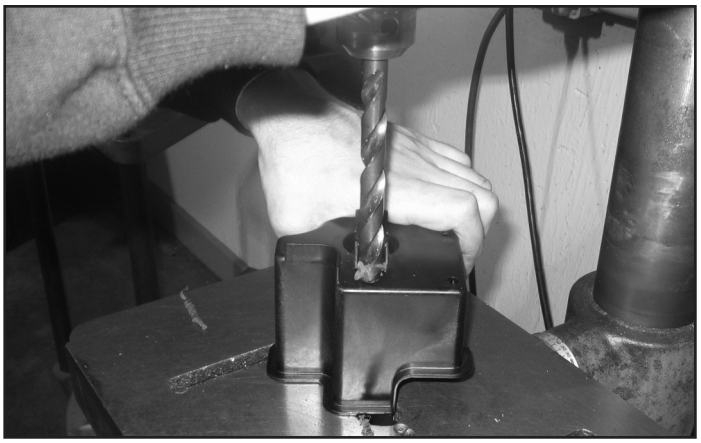
1- Remove the stock oil supply and return fittings from the transmission.
2- Install two supplied ⅜ NPT pipe plugs (S&S PN 50-8330) in the oil fitting location.

NOTE: *Apply thread sealant to all tapered pipe threads.*

3- Drain the oil from the oil pan—see the proper factory service manual for instructions—and then remove the oil pan from the motorcycle.
4- Place the supplied template (53-0080) over the oil pan baffle and use a scribe to mark the location of the ½" hole as shown in **Picture 8**. Use a drill press to machine the ½" hole as marked in **Picture 8a**. Use a small file or deburring tool to make sure no chips or pieces are left on the ½" hole and then clean the oil pan and baffle with a solvent before reinstalling the pan with a new gasket on the motorcycle.



Picture 8

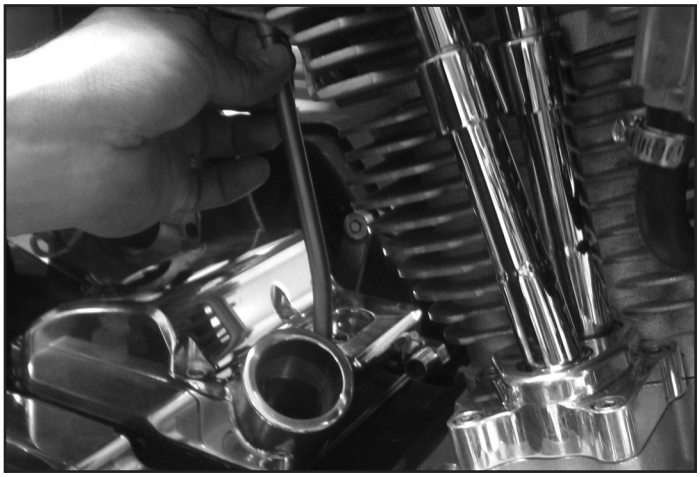


Picture 8a

5- Remove the transmission top cover. Remove the neutral indicator switch, vent line and fitting from the transmission top cover.

6- Install the neutral indictor switch, vent line and fitting on the new S&S transmission top cover (S&S PN 56-1615).

7- Slide the oil feed line (S&S PN 31-0449) through the hole in the top cover closest to the oil filler/dipstick boss. Place a new top cover gasket (S&S PN 56-1261) on the transmission case and position the new S&S® top cover on it. Rotate the oil feed line so it will pass through the ½" hole in the baffle. Be sure the bend in the oil feed line orientation is to the rear of the motorcycle. **See Picture 9.**



Picture 9

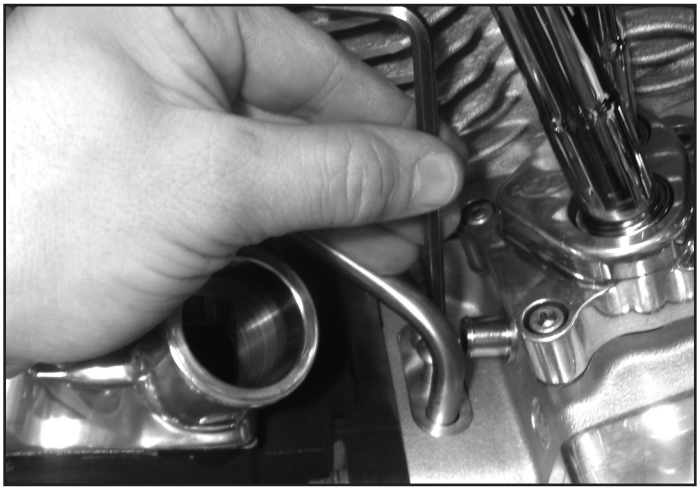
8- Install the transmission top cover screws and washers according to Detail A. Use blue threadlock on the screws, but leave them loose at this time. *See Detail A in exploded view of replacement parts for Harley-Davidson® Dyna® on page 11.*

9- Remove the oil line retention plate, plugs and seals from the top of the engine crankcase. Remove seals from the plugs. Discard the plugs.

Picture 10

10- To install the oil lines (S&S PN 31-0447 and 31-0448), orient the ends and openings so they are parallel. Insert the lines through the oil line retention plates, then the included washers (S&S PN 50-0439) and, last the seals (S&S PN 50-8271) on each line end. The ends of the lines should protrude through the seals about ⅛ inch.

11- Position oil line assembly on both the transmission top cover and crankcase and press down until lines are firmly seated in the counterbores in the crankcase and transmission cover.



Picture 11

12- Press the oil line retention plates into place until they seat. Install the two screws (5/16-18 x ¾ button head) through the oil line retention plates. First screw goes in the transmission top cover and the second mounts into the crankcase near the rear motor mount. Treat both screws with blue threadlock and tighten to 18-ft-lbs.

13- Tighten transmission top cover screws to 100-120 in-lbs.

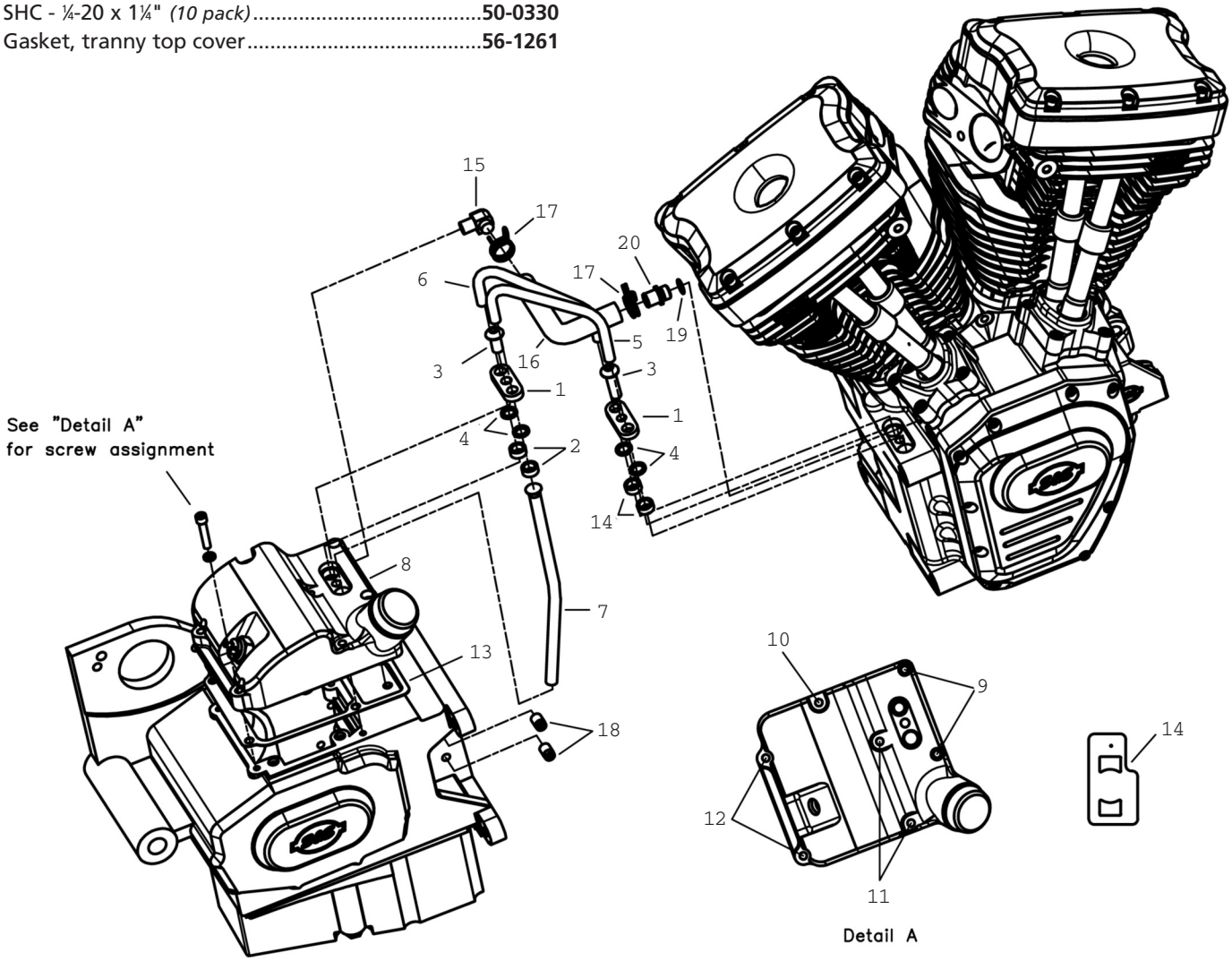
14- Install the vent line (S&S PN 50-8291) with clamps (S&S PN 50-8156).

15- Reconect neutral switch wires.

16- Check function of neutral switch.

S&S® Replacement Parts for Harley-Davidson® Dyna® Models

1- Plate **106-1176**
2- Seal *(4 pack)*.....**106-1177**
3- BHSHCS 5/16-18 x ¾ *(10 pack)*.....**106-1178**
4- Washer *(4 pack)*.....**106-1185**
5- Line, oil supply **31-0447**
6- Line, oil return.....**31-0048**
7- Line assembly, oil feed.....**31-0449**
8- Top cover **56-1615**
9- SHC - ¼-20 x 1½" *(10 pack)*.....**106-1179**
10- SHC - ¼-20 x 2¼" *(10 pack)*.....**106-1180**
11- SHC - ¼-20 x 1¾" *(10 pack)*.....**106-1181**
12- SHC - ¼-20 x 1¼" *(10 pack)*.....**50-0330**
13- Gasket, tranny top cover.....**56-1261**
14- Drill Template.....**106-1188**
15- Fitting *(5 pack)* **106-1182**
16- Hose, 90-degree bend **50-8292**
17- Clamp *(10 pack)*.....**50-8156**
18- Plug, pipe *(10 pack)*.....**106-1175**
19- O-ring *(10 pack)*.....**106-1183**
20- Fitting *(2 pack)* **106-1173**



C- Oil recommendations

NOTES

- *S&S® Cycle recommends the use of Mobil 1® V-TWIN 20W-50 synthetic oil in our engines.*
- *S&S Cycle recommends the use of S&S® oil filters, PN 31-4103 (black), or PN 31-4104 (chrome).*

All reference to Harley-Davidson® part numbers is for identification purposes only. We in no way are implying that any of S&S® Cycle's products are original equipment parts or that they are equivalent to the corresponding Harley-Davidson® part number shown.

If not using Mobil 1® V-TWIN 20W-50:

Viscosity	Ambient Temperature (° F)
SAE 20W50	Above 20° - 100°
SAE 50	Above 60° - 100°
SAE 60	Above 80° - 100°

D- Verify oiling system operation before starting

⚠ CAUTION

If engine is run with foreign material in the oil tank, engine damage will occur. Engine damage caused by foreign material in the oil tank is not covered under the S&S warranty.

⚠ CAUTION

Restricted oil flow may result in extensive engine damage not covered under warranty.

⚠ CAUTION

Improper installation of oil lines or fittings may result in parts damage not covered under warranty.

1- Fill the oil tank to the proper level.

2 - Remove spark plugs. Ground plug wires to cylinder head with either a jumper wire or through a test plug.

3- Remove oil sender unit.

4- Turn ignition on and turn the engine over with the starter motor until engine oil appears at the oil pressure sender hole.

5- Re-install and re-connect oil sender unit.

6- Verify that engine oil is returning to oil tank.

7- Start motorcycle. Verify oil pressure by watching oil pressure light.

NOTES

- *If oil fails to appear at oil sender hole within 30 seconds of starter operation, allow the starter to cool. Verify that oil line routing is correct and that the oil tank is full to the proper level.*
- *Oil pressure indicator lamp should light when ignition is turned on. Lamp will go out after engine is started and there is oil pressure at the switch in the crankcase.*

⚠ CAUTION

Avoid excessive time of starter engagement. Overheating of starter motor will result in damage. Oil pump should prime and deliver oil to the oil sender hole within 30 seconds.

8- Exhaust System

NOTE - *The engine must be correctly mounted into the frame before the exhaust system is installed.*

1- Place new woven-metal gasket into exhaust ports of cylinder heads.

2- Inspect the exhaust pipe header flanges and retaining rings. Replace if distorted, warped, or otherwise damaged.

3- Apply a high-temp. anti-seize lubricant to threads of exhaust studs at cylinder heads.

4- Install exhausts to cylinder heads. Hand tighten exhaust stud nuts.

5- Attach exhausts to lower mounting bracket. Shim if necessary. Hand tighten mounting hardware.

6- Tighten exhaust flange nuts at head to 60-80 in-lbs.

⚠ WARNING

In some instances, brake master cylinder must be spaced out from frame to clear crankcase. UNDER NO CIRCUMSTANCES SHOULD MASTER CYLINDER OR BRAKE LINE BE ALLOWED TO CONTACT EXHAUST PIPE IN FINAL INSTALLATION. Heat transferred to brake fluid may expand and cause brakes to seize, resulting in possible fire hazard and loss of control of motorcycle with injury or death to rider and others.

NOTE - *Make certain that the exhaust system is not pre-loaded, or in a bind, at the lower mounting points. Make all spacing adjustments prior to final-tightening of the upper exhaust mounting hardware at the cylinder heads. Failure to follow this procedure may cause excessive vibration and result in failure of exhaust pipes or mounting hardware.*

9- Initial Start-Up And Engine Break-In

NOTE - *engines are designed for high performance and as such are not as tolerant of inadequate break-in as stock or lower performance engines. Correct break-in will assure longer engine life and will prevent unnecessary engine damage. Engine damage caused by improper break-in is not covered under the S&S® warranty.*

A- Initial start-up

1- For the initial start up, the fuel and ignition systems should be adjusted to their baseline settings. (Baseline settings allow the bike to start and run, and are the starting point for tuning.) This is adequate for the initial start-up and heat-cycling of the engine.

NOTE - *Because there are several ignition and fuel system combinations possible with the S&S® T111 engine, baseline settings are not listed here. Refer to the appropriate ignition or fuel system instruction sheet.*

2- Run engine approximately one minute at 1250-1750 rpm. DO NOT crack throttle or subject to any loads during this period as head gaskets are susceptible to failure at this time. During this time, check to see that oil pressure is normal, and that oil is returning the oil tank.

3- Shut off engine and thoroughly check for any oil leaks, fuel leaks, or other problems. Let engine cool to the touch.

4- After engine has cooled, start up again and allow the motor to build some heat. Engine should not be run longer than three to four minutes. When the cylinders become warm/hot to the touch (approximately 150°) shut the motor down and let it cool to room temp. Follow the same cautions as for the initial start-up, and continue to watch for problems.

5- Repeat this procedure 3 or 4 times. Each successive time it should take slightly longer to warm up and you can increase the temperature slightly each time. You can be more liberal each time with the rpm, gently vary rpm continuously from idle up to 2500 rpm in the final cycle. The motor should not reach full operating temperature during these cycles. Do not allow engine temperature to become excessive.

B. Engine break-in

1- Closely monitor engine for excessive heat build-up. Do not allow the engine to idle for long periods of time. Be especially watchful when air temperatures exceed 90 degrees. Slow speed operation in urban areas during the summertime is especially hard on engines.. Temperature for engine oil should be between 180° - 240° F. If engine oil temperature stays above 220° F, and correct ignition timing has been verified, S&S® Cycle suggests that an oil cooler be installed. Do not run engine under conditions where oil temperatures continue to remain high.

2- For the first 50 miles ride the motorcycle in a very conservative manner. The first 50 miles are most critical for new rings and piston break-in. Engine damage is most likely to occur during this period. Keep heat down by not exceeding 2500 rpm. Avoid lugging the motor, riding in hot weather or in traffic. Vary the engine speed. Do not lug the engine. Change the oil at 50 miles. This will remove the heavy accumulation of break in residue from the oiling system.

3- The next 500 miles should be spent running engine no faster than 3500 rpm or 60 mph. Correct any obvious ignition or fuel problems, if present. Avoid continuous steady speeds, and do not lug the engine. Vary engine rpm. change the oil again at 500 miles.

⚠ CAUTION

Lugging or running engine prematurely at sustained high rpm may result in damage to pistons and other engine components. S&S voids it's guarantee if engine is not broken in properly.

4- For the balance of the first 1000 miles the motor can be run in a normal but conservative manner. You can be more liberal with the rpm range and motorcycle can be operated at normal highway speeds. Avoid overheating or putting any hard strain on the engine: no drag racing, dyno runs, excessive speed, trailer towing or sidecar operation.

5- After 1000 miles, verify Ignition and fuel system settings and adjustments. Change the engine oil. The break in process is complete.

10- Tuning Guidelines

Ignition timing and carburetor jetting are responsibilities of the customer. If not thoroughly familiar with these procedures, contact a professional mechanic.

A- Exhaust Systems

Muffled exhaust systems.

If you have an existing 2-into-2 system that uses slip-on style mufflers, whether it is an OEM or an aftermarket system, we recommend the new S&S slip-on mufflers. S&S® dyno tests achieve almost 8 more horsepower and 5 ft. lbs. of torque on a stock Harley-Davidson® Twin Cam 88® engine using stock header pipes and S&S slip-on mufflers, and S&S Super Sidewinder® engines have produced 1-1.1 horsepower per cubic inch using stock style exhaust and S&S slip-on mufflers. These mufflers will allow your engine produce more horsepower and torque than straight-through drag pipes in street and highway driving, and work equally well on both stock and large displacement engines.

Drag pipes

While drag pipes can be used with good results to achieve top end horsepower, they are generally not recommended for street applications. Carburetor adjustment and jetting is generally easier for engines with muffled exhaust systems.

B- Gearing

Gearing depends on the total weight of the machine and rider, the size of the engine, cam, exhaust system and type of riding. Most high performance engines, and particularly those with larger displacements, are capable of pulling more gear. We suggest you break the engine in with stock gearing to minimize the load on the engine. After the engine is broken in, you will have a better feel of its potential and can change gearing accordingly.

The following formula will determine final drive gear ratio:

$$\text{Engine Revolutions Per One Revolution of Rear Wheel} = \frac{\text{(Clutch Sprocket*) x (Rear Wheel Sprocket*)}}{\text{(Motor Sprocket*) x (Transmission Sprocket*)}}$$

*Number of teeth on each sprocket

11. Engine Specifications & Torque Values

Displacement	Bore	Stroke	Compression Ratio
111”	4⅛”	4⅛”	9.77:1

Cylinder Heads	Specification
Valve guide in head (tight)	.0015”-.003”
Valve seat in head (tight)	.005”-.0075”

Crankcase	Specification	Service Wear Limit
Timkin® race in case (tight)	.001”-.003”	less than .0025”
Pinion race in case (tight)	.001”-.003”	less than .0025”

Valves (Fit in guide.)	Specification	Service Wear Limit
Intake	.0012”-.0015”	.0025”
Exhaust	.0018”-.0023”	.0035”
Seat Width	.040”-.062”	
Stem Protrusion	2.045”-2.060”	2.080”

Rocker Arms	Specification	Service Wear Limit
Shaft fit in bushing (loose)	.0007”-.0018”	.0035”
Bushing fit in rocker arm (tight)	.002”-.004”	

Hydraulic Lifters	Specification	Service Wear Limit
Lifter fit in guide (loose)	.0006”-.0017”	.003”

Flywheels	Specification	Service Wear Limit
Runout (shaft at flywheel)	.0005”-.001”	.003”
End play	.001”-.005”	exceeds .005”

Pistons	Specification	Service Wear Limit
Fit in cylinder	.002”-.0025”	.005”
End gaps:	.017”-.025”	.028”
Top two compression		
Oil control rails	.016”-.035”	.050”

Connecting Rods	Specification	Service Wear Limit
Crankpin bearing Running clearance	.001”-.0012”	.002”
Piston pin fitment in rod	.0005”-.001”	.002”
Connecting rod side-play	.015”-.035”	.040”

Torque Values	Specification	S&S Suggestion
Rocker box hardware ¼"	120 in-lbs.	Loctite® 243
Rocker box hardware 5/16"	18 ft-lbs.	Loctite 243
Tappet guide fasteners	120 in-lbs.	Loctite 243
Pushrod locknuts	120 in-lbs.	
Cylinder head bolts	See chart on page 11.	
Crankcase fasteners ¼"	120 in-lbs.	
Crankcase fasteners 5/16"	15 ft-lbs.	
Gearcover fasteners	120 in-lbs.	Loctite 243
Intake manifold-to-head	16 ft-lbs.	Loctite 243
Intake manifold-to-carb	18 ft-lbs.	Loctite 243
Exhaust flange-to-head	60-80 in-lbs.	Anti-seize
Spark plug	11-18 ft-lbs.	Anti-seize
Cylinder studs	10 ft-lbs.	Loctite 262
Piston oiler screws	35 in.-lbs.	Loctite 243

12- Service Intervals

S&S® Recommended Regular Service Intervals	
Item	**Interval**
Engine Oil & Filter	Change at 50, 500, 2,500 miles, every 2,500 miles thereafter. [1]
Air Cleaner	Inspect at 50 and 500 miles, every 2,500 miles thereafter. [2]
Petcock, Lines, & Fittings. Vacuum Lines	Inspect at 50 and 500 miles, every 2,500 miles thereafter.
Fuel Filters	Every 5,000 miles.
Engine Idle Speed	Adjust as required.
Throttle & Enrichment Device Control	Inspect and lubricate throttle cables at 500 miles and every 2,500 miles thereafter.
Spark Plugs (Champion RA8HC or equiv.)	Inspect every 5,000 miles. Replace every 10,000 miles or as needed.
Ignition Timing - 28 deg. total advance max.	Inspect every 5,000 miles.
Engine Mounts	Inspect every 500 miles and every 5,000 miles thereafter.
External Fasteners (except cyl. head bolts)	Re-torque at 500 miles and every 5,000 miles thereafter.

[1] S&S recommends that petroleum-based oil not specifically formulated for air cooled motorcycles should be changed every 1,000 miles.
[2] Replace more frequently if required or if engine is operated in a dusty environment.

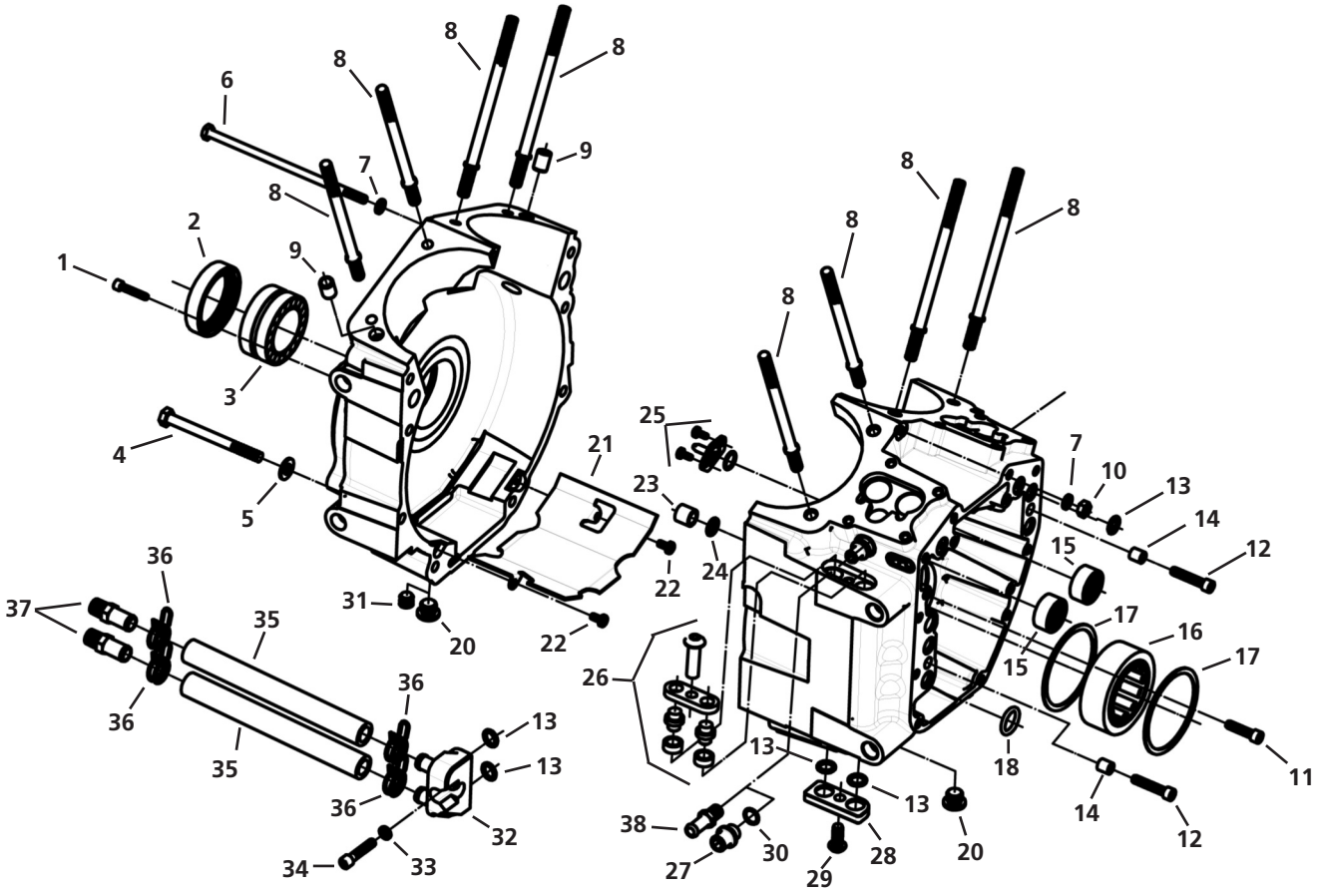
Replacement Parts for S&S® Crankcases for Harley-Davidson® Twin Cam 88® Engines

1. Bolt, stator 10-24 x1" SHC - 4 required
(H-D#2720) *(10 Pack)* **50-0194**
2. Seal, sprocket shaft (H-D#12068) **31-4035**
3. Bearing, Timken® sprocket shaft (H-D#9028)..... **31-4013**
4. Bolt, case 5/16" -24 x 2¾" HHC - 8 required
(5 Pack) **50-0190**
5. Washer, flat 5/16" x 11/16" x 1/16" - 8 required
(10 Pack) **50-7069**
6. Bolt center case ¼" -28 x 6" HHC Grade 8
(5 Pack) **50-0221**
7. Washer, flat, ¼" x .474" x .050" *(10 Pack)*..... **50-7076**
8. Cylinder studs (H-D#16834-99) *(8 Pack)* **31-2340**
9. Dowel, cylinder deck - 2 required
(H-D#16595-99) *(10 Pack)* **50-8179**
10. Nut ¼"-28 Grade 8 - 1 required *(10 Pack)*..... **50-5014**
11. Bolt, cam plate ¼" -20 x 1" SHC - 4 required
(10 Pack) **50-0244**
12. Bolt, cam plate ¼" -20 x 1¼" SHC - 2 required
(10 Pack) **50-0153**
13. O-ring, cam plate - 9 required
(H-D#11301) *(10 Pack)* **50-8066**
14. Dowel, cam plate - 2 required (H-D#16589-99) **50-8148**
15. Bearing, inner cam (H-D# 9198)..... **31-4080**
16. Bearing, pinion shaft – Fits all S&S and OEM 2000-'02 (Balanced models only) & all OEM 2003-up
(H-D#24604-00 & #24604-00C) **31-4085**
17. Retaining ring, internal, spiraloc
(H-D#35114-02) *(6 pack)*..... **50-1047**
18. O-ring, oil pump 11/16" I.D. x 15/16" O.D. x 1/8" CS
(H-D#11293) **50-8039**
19. Switch, oil pressure
Case with rear motor mount, 1948-'99 big twin
(H-D#26561-84) (Not shown) **31-2016**

NOTE: *Stock style use stock pressure switch.*

20. Plug, magnetic drain **50-8335**
21. Baffle Plate **31-0119**
22. Screw 10-24 x 3/8" panhead - 2 required
(10 Pack) **50-0139**
23. Dowel, case alignment - 2 required
(H-D#16574-99) *(10 Pack)* **50-8109**
24. O-ring, case alignment, 9/16" I.D. x 11/16" O.D. x 1/16" CS
2 required, (H-D#26432-76A) *(10 Pack)* **50-8102**
25. Piston oilers - (Kit of 2) (H-D#22371-99)..... **31-2026**
26. Hardware kit, oil line plugs..... **50-1081**
27. Fitting, crankcase vent
1999-'00 *(2 Pack)*..... **106-1172**
2001-'06 *(2 Pack)*..... **106-1171**
28. Plate, oil line cover **106-1184**
29. BHSH CS 5/16-18 x ¾" *(10 Pack)*..... **106-1178**
30. O-ring *(10 Pack)* **106-1183**

These parts are for crankcases manufactured before 8-1-06:
31. Plug, sump (H-D#765)..... **50-8330**
32. Oil conduit block..... **31-2076**
33. Washer, flat ¼" chrome *(12 Pack)*..... **50-7013**
34. Bolt, ¼" -20 x ¾" SHCS - 1 required *(12 Pack)*..... **50-0144**
35. Hose, oil, inlet/outlet..... **50-8157**
36. Spring clips *(10 pack)*..... **50-8156**
37. Oil line fittings, inlet/outlet - 2 required..... **50-8158**
38. Oil line fitting- vent (H-D# 25259-93A)..... **50-8146**



All reference to H-D® part numbers is for identification purposes only. We in no way are implying that any of S&S Cycle's products are original equipment parts or that they are equivalent to the corresponding H-D® part number shown.